

---

## LOAD TESTING OF Z-CLIPS

**Eagle Mouldings**  
Attn: Mr. Thor Smith  
50 Medina St. So.  
Loretto, MN 55357

Date: April 19, 2016  
Author: Matthew Rootes  
Report Number: ESP021556P  
Purchase Order Number: N/A

Respectfully submitted,



Luke Tavernit  
Materials Testing and Analysis Engineer  
Product Evaluation Department  
Phone: (651) 659-7271

Reviewed By,



Matthew Rootes  
Associate Test Engineer  
Product Evaluation Department  
Phone: (651) 659-7429

F:\Product\Experimental Mechanics\2015 Client Projects\Eagle Mouldings

---

It is our policy to retain components and sample remnants for a minimum of 30 days from the report date, after which time they may be discarded. The data herein represents only the item(s) tested. This report shall not be reproduced, except in full, without prior permission of Element Materials Technology.

ITAR Controlled Data: This document contains technical data whose export and re-export/retransfer is subject to control by the U.S. Department of Commerce under the Export Administration Act and the Export Administration Regulations. The Department of Commerce's prior written approval is required for the export or re-export/retransfer of such technical data to any foreign person, foreign entity or foreign organization whether in the United States or abroad.

This project shall be governed exclusively by the General Terms and Conditions of Sale and Performance of Testing Services by Element Materials Technology. In no event shall Element Materials Technology be liable for any consequential, special or indirect loss or any damages above the cost of the work.

## INTRODUCTION

This report presents the results of the vertical and lateral load testing of 1.5” Z-clips, and vertical load testing of 2” Z-clips and 48” Z-Clips. Mr. Thor Smith of Eagle Mouldings submitted the samples for the testing.

## OBJECTIVE

The scope of our work was limited to vertically and laterally loading the Z-clips in their normally installed position and providing a certification report of the results. Testing was completed on March 11, 2016.

## SAMPLE IDENTIFICATION

Twelve (12) 1.5” Z-clips were tested in the vertical, pictured in Figure 1, and lateral positions, pictured in Figure 2, for a total of six (6) tests. Additionally, six (6) 2” clips were tested in the vertical positions, for a total of three (3) tests. Three (3) 48” clips were also submitted and subjected to vertical load testing.

## CONCLUSIONS

The four tables below show the data collected from the load tests. Failure occurred in the samples due to screw pullout and wood shearing in the vertical load tests, pictured in Figure 3 and Figures 4-6 respectively, and screw pullout in the lateral load test, pictured in Figure 7. Note that in the 48” Z-Clip Test the 2” clips opposite the 48” clip pulled out of board 4, pictured in Figure 8. Note that some bending and screw pullout occurred on the 48” Z-Clip, but it was not permanently deformed after the testing was complete, as shown in Figures 9-12. Some yielding occurred in the screws but this occurred after the peak load had been reached.

Vertical Load Test Results  
(1.5” Clips – ID # EAM-62525)

Specimen	Board #	Pullout Load (lb)
1	1	465.8
2	2	381.6
3	2	418.4
	Mean	421.9
	Sample Standard Deviation	42.2
	Coefficient of Variance	10.0

Lateral Load Test Results  
(1.5” Clips – ID # EAM-62525)

Specimen	Board #	Pullout Load (lb)
1	1	99.5
2	2	99.5
3	1	118.8
	Mean	105.9
	Sample Standard Deviation	11.1
	Coefficient of Variance	10.5

## CONCLUSIONS (cont'd)

Vertical Load Test Results  
(2" Clips- ID # EAM-375)

Specimen	Board #	Pullout Load (lb)
1	3	491.1
2	3	521.5
3	3	423.3
	Mean	478.6
	Sample Standard Deviation	50.3
	Coefficient of Variance	10.5

Vertical Load Test Results (48" Clips)

Specimen	Board #	Pullout Load (lb)
1	4	708.8
2	4	700.9
3	4	701.0
	Mean	703.6
	Sample Standard Deviation	4.5
	Coefficient of Variance	0.6

The average load achieved by a 1.5" Z-clip was determined to be 421 lb with a vertical load and 105 lb with a lateral load. The average load achieved by a 2" Z-clip was determined to be 478 lb with a vertical load. The average load achieved in the 48" Z-Clip opposite three 2" Z-Clips was determined to be 703 lb.

## TEST PROCEDURE

The Z-clips were installed into 2"x4" SPF (Spruce, Pine, Fir) boards with No. 8 – 3/4" wood screws. 1/8" diameter pilot holes were drilled into the 2"x4" prior to installing the No. 8 – 3/4" wood screws. Three 8' boards were selected for installation, and cut into 6" pieces for testing. For the 48" Z-Clip testing, two 8' 2"x8" boards were cut to 54" lengths. Boards 1 and 2 were used in testing the 1.5" clips, and Board 3 was used in testing the 2" clips. Board 4 and 5 were used in testing the 48" clips. The 48" clips were tested with a single 48" Z-clip on one side, and three 2" Z-clips spaced 16" on center on the opposite board. The moisture content of the boards used in testing was determined per ASTM D4442-15, and the specific gravity was determined. Boards 4 and 5 were tested using a moisture meter. Two 1" samples were cut from each Board 1 and Board 2 and 3 1" samples were cut from Board 3. The 1" samples were used to determine the moisture content and specific gravity. Samples 1A and 1B were cut from the same board.

Board Data (1.5" Clips)

2" x 4" SPF 8' Samples		
Sample	Moisture Content (%)	Specific Gravity
1A	10.58	0.43
1B	9.32	0.45
2A	8.45	0.39
2B	9.75	0.39

## TEST PROCEDURE (cont'd)

Board Data (2" Clips)

2" x 4" SPF 8' Sample		
Sample	Moisture Content (%)	Specific Gravity
3A	5.87	0.36
3B	8.94	0.37
3C	6.18	0.39

Board Data (48" Clips)

2" x 8" SPF 8' Sample		
Sample	Moisture Content (%)	Specific Gravity
4A	7.2	0.35
5A	8.7	0.49

The test was conducted at a constant cross-head speed of 0.4 in/min. The test was run until 10% of the maximum load attained during testing remained or until failure was obvious. See photographs below for images of the test setup.

## CALIBRATED TEST EQUIPMENT

Honeywell Temp/RH Chart Recorder, ID MM190-024, calibrated 8/5/15, due 8/5/16

MTS Universal Test Machine, ID MM210-009.3 & 6, calibrated 4/8/15, due 4/8/16

MTS Load Cell, 11,200 lbf Capacity, ID MM210-009.2, calibrated 4/8/15, due 4/8/16

## NOTES

Element Materials Technology St. Paul is an independent test laboratory that has successfully completed the A2LA evaluation process and is accredited to perform Standardized Test Methods on the following products or types of products: adhesives and sealants; automotive components; coatings; consumer products; electronics and electromechanical assemblies; fasteners; fiberglass; furniture; glass; geotextiles; hoses; insulation; mattresses; medical devices; metals and alloys; packaging; plastics and polymers; pipes; tapes; valves and fittings; pressure vessels; rubber and elastomers; textiles; and weldments.

## PHOTOGRAPHS

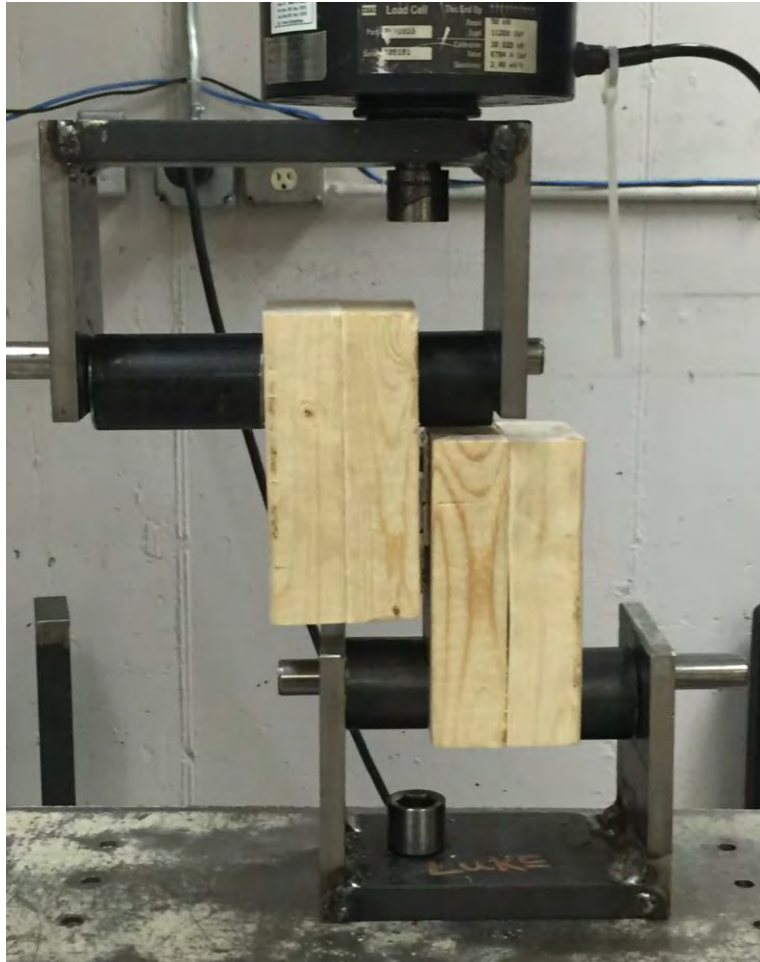


Figure 1. Vertical Load Test Setup

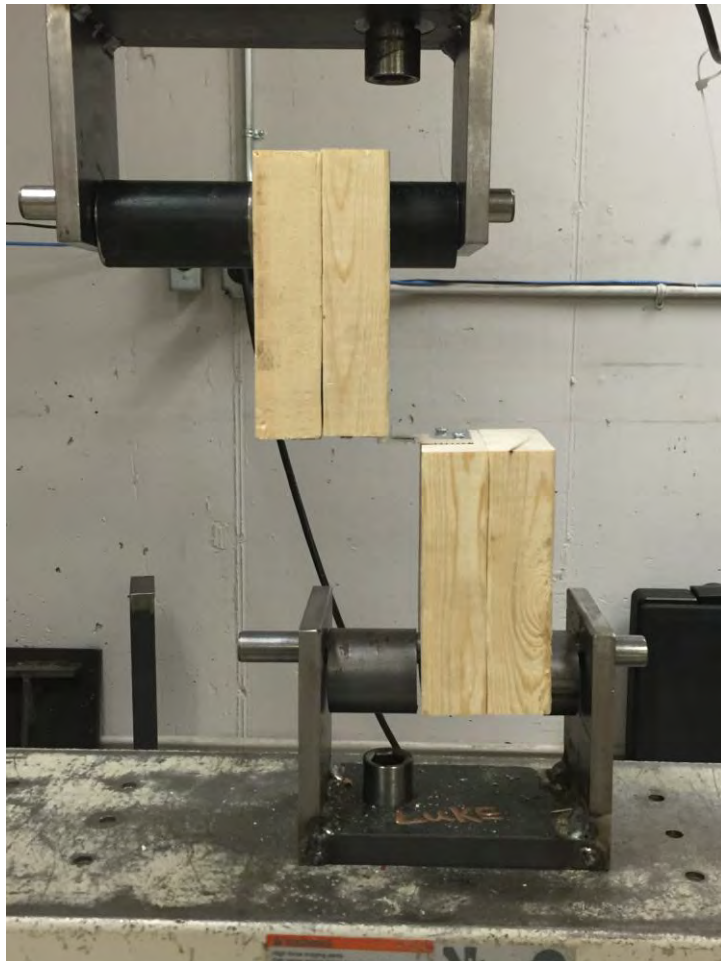


Figure 2. Lateral Load Test Setup



Figure 3. Vertical Load Test Screw Pullout





Figure 4. Wood Shearing Failure (Vertical Test)



Figure 5. Wood Shearing Failure (Vertical Test)





Figure 6. Wood Shearing Failure (Vertical Test)



Figure 7. Screw Pullout Failure (Lateral Test)



Figure 8. Screw Pullout of 2" Z-Clip opposite 48" Z-Clip



Figure 9. Bending of the 48" Z-Clip

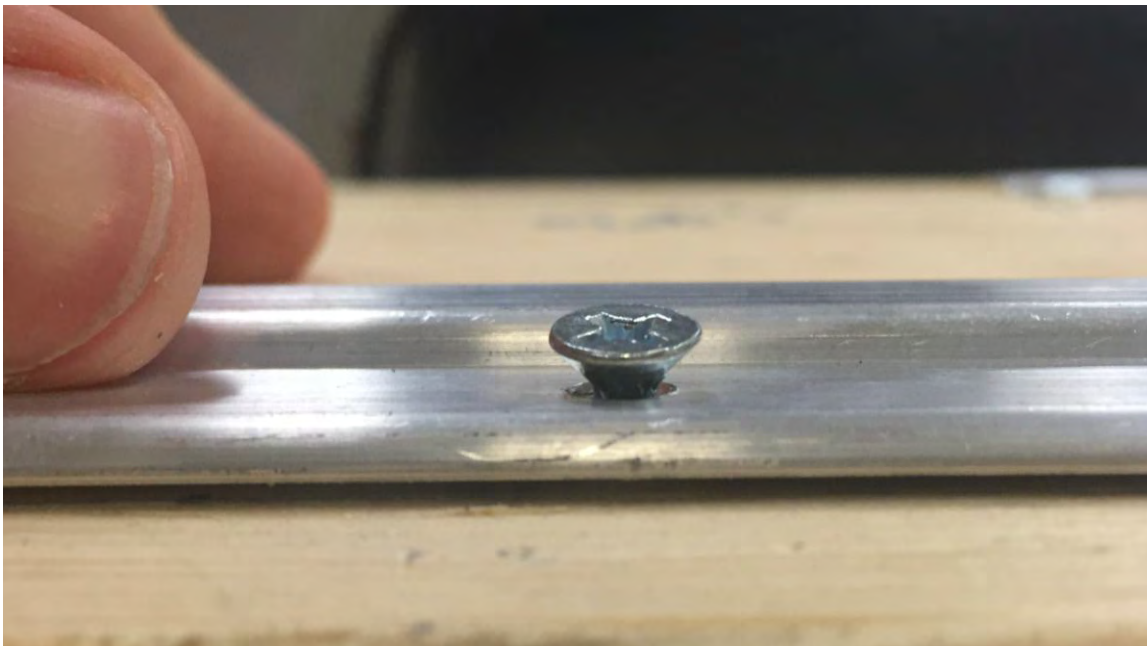


Figure 10. Screw Pullout on 48" Z-Clip



Figure 11. Screw Pullout of 2" Z-Clip opposite 48" Z-Clip.



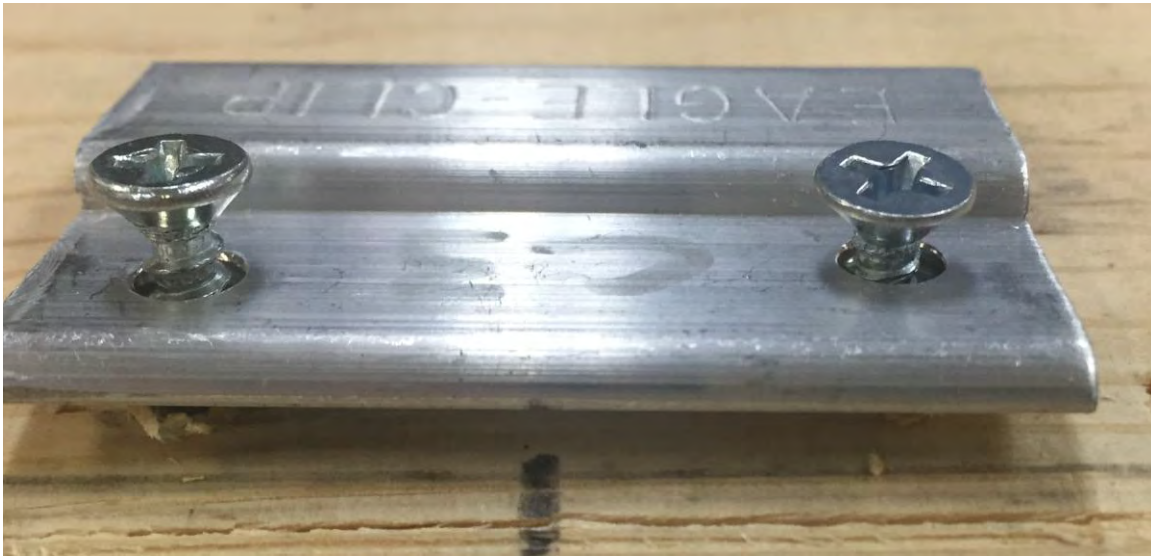


Figure 12. Partial Pullout of 2" Z-Clip opposite 48" Z-Clip